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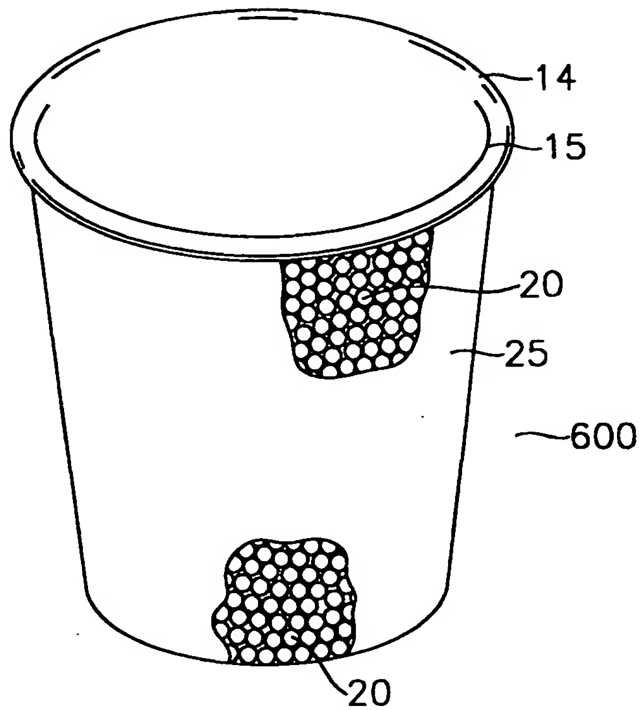
(54) **CONTENEURS ISOTHERMES A PAROI SIMPLE ET A PAROI DOUBLE**

(54) **SINGLE AND DOUBLE WALL INSULATED CONTAINERS**



(57) Paper Insulating containers are constructed by applying a thin extruded Polymer Foam sheet to a paper cup outer sidewall. The Foam sheet can be laminated to paper board to form a wrap. The laminate is die cut to the desired shape and coverage. Polyethylene and polypropylene foam are the preferred materials but thin wall polystyrene foam can be used. Another insulated cup design incorporates a Polymer Insert and a paper outer cup to form a double wall structure. The designs are rated to operate with contents of 190 °F. The two wall cup provides a low surface temperature typically in the range of 115 °F to 130 °F while the paper foam laminate wrap provides surface temperatures in the 125 °F to 135 °F range using foam of .040" to .060" thick.

ABSTRACT

Paper Insulating containers are constructed by applying a thin extruded Polymer Foam sheet to a paper cup outer sidewall. The Foam sheet can be laminated to paper board to form a wrap. The laminate is die cut to the desired shape and coverage. Polyethylene and polypropylene foam are the preferred materials but thin wall polystyrene foam can be used.

Another insulated cup design incorporates a Polymer Insert and a paper outer cup to form a double wall structure. The designs are rated to operate with contents of 190°F. The two wall cup provides a low surface temperature typically in the range of 115°F to 130°F while the paper foam laminate wrap provides surface temperatures in the 125°F to 135°F range using foam of .040" to .060" thick.

Background of the Invention

1. Field of Invention: This invention describes insulating disposable cups and containers which have low thermal conductivity to maintain the packaged contents at preferred temperature and mild outside temperature in the holding areas. They are used for hot beverages and cold items such as ice cream. One design employs a pre-formed extruded polymer foam which is applied to the container sidewall. Closed cell extruded foam is the preferred material. To improve printability of the wrapped design insulation foam material it can be bonded to paperboard to form a insulating wrapper. A flat handle version can be die cut and bonded to the container for use in deli and bagel shops. A foam thickness of about .030 to .050 provides adequate insulation. If the polymer foam is a thin wall styrofoam is can be used in the fast food market.

It is common knowledge that Polymer Foams are among the best heat insulating materials. There are natural polymers such as cellulose which is the primary part of wood fiber and cotton. Polyethylene foam is a synthetic polymer. When this polymer is extruded through a long slot die under heat and pressure a foamed sheet is produced which is cellular consisting of poly {multi} hydro-carbon chains. These chains are not induced to cross-link {interconnect}. The foam can be bonded to most substraits such as paperboard as it is being extruded. The closed cell foams contain encapsulated atmospheric air. Polyethylene and polypropylene foam are the preferred foams although copolymer foams may be used. The foams contain as much as 50,000 air cells per cubic inch. In addition to the wrapped cups insulating ability, other improvements to the designs can be employed such as reduced wrapper coverage to decrease cost of materials, shaped edges, butt joint or overlap finished seam, embossed features, gripping surface, multi-surface graphic with coordinated colors and patterns to list a few possibilities as well as other nesting features.

In the double wall design of this invention improved spacing features are described to align the sidewalls and allow equal inter-wall air space necessitated by the larger cup sizes used

today. This improves insulation by preventing tilting of the inner container during assembly since any small offsets at the top are magnified by the length of the cup sidewall. Methods to minimize contact between the sidewalls and bottoms to reduce heat transfer by conduction are shown in the drawings and descriptions. There are also variations in nesting methods such as outer protrusions, inner embossments, false bottoms and one or multiple diameter increases or reductions. A diameter reduction at the top provides spacing support between the double walls it also defines the inter sidewall air space to follow. A diameter reduction near the insert's bottom provides a ridge for cup nesting. The double wall design drawings and description show other arrangements such as removal of the paper cup's bottom disk or replacing the paper bottom disk with one made of a polymer. This polymer bottom is easier to emboss with spacing or locking features. In one variation the paper cup's top rim is removed to reduce cost. In this case the inner polymer cup's top rim is used for drinking and securing the lid. Other modifications will also allow the inner polymer cups top rim to be shortened. In this case a moisture barrier will be required in that area. Vents of various shapes can be part of the paper bottom or sidewall for moisture and heat to escape or for decoration. Interlocking, spaced, recessed or embossed bottoms can also be featured. If both bottoms are used a logo can be imprinted on the insert bottom outside surface to be visible inside the cup if the insert is translucent. Removal or use of thinner moisture coating on the paper cup inside surface of the two wall design will reduce cost in which case an adhesive is required for the side seam, as can be seen in the drawings and their descriptions.

In the wrapped or double wall design there is enough trapped air to insulate at 190 degrees and provides a low outer surface temperature. After testing it was found that to design a double wall structure with enough air insulation between the adjacent sidewalls, separations of about .062 to .187 of an inch is required in the upper and middle areas with spacings up to .250 inch offering lower surface temperatures. Typically if the majority of

spacing is in the 0.1" to 0.2" range the insulation is adequate. Increased air space can be provided at the bottom area. At the top area beneath the rim there may be some contact for spacing and alignment but that should be minimized and the spacing between sidewalls may be less than .062 in small areas at the top. These spacings provide a temperature of about 130°F on the outer cup surface with a content temperature of 190°F. The lowest outer wall temperature where obtained when the sidewall angle differences were large. In this case surface temperatures of about 115°F were obtained. Typically most the air space should be .187 of an inch or more in the center cup area and as close to .062 as possible near the top, the lower end of the cup can be up to .250 or more depending on cup sizes. In testing, bottom spacing between insert and outer paper cup was about 1/8 to 1/2 inch. There are tradeoffs but generally these dimensions are typical. The end result desired is an outer sidewall temperature of 130°F or lower. It was noted that most prior art did not specify these critical spacings or outer sidewall temperature. Perhaps at that time coffee was brewed at lower temperatures. For example one prior art patent 4,261,501.. Watkins specified use at 170°F to 175°F which is not sufficient in today's market of 190° brewing temperatures. The cups described in this patent were designed to accommodate the industry specifications of the Specialty Coffee Association of America for coffee brewing and holding temperatures. Therefore prior art that was not designed to these specifications may not meet market needs. In prior art insulated designs, there are disclosed other means of contact with the outer sidewall. In some cases vertical ribs were spaced around the inner cup's sidewall. It was discovered during testing of the designs herein disclosed that any contact between the inner and outer cup sidewalls degrades the cup's insulating ability since any intermediate material provides a path for heat to be conducted to the outer surface. The polymer liners suggested in prior art may not withstand 190°F temperatures. During test of this invention polystyrene, if too thin, deformed at the bottom. It was further discovered that fillers, colorants, a thicker polymer or

polymers of higher temperature rating should be used. In the case of using polymers at lower temperatures for containers, the polymers used must withstand very low or freezing temperatures.

Evaluation testing employed the use of outer paper cups in the 12, 14, 16 and 20 ounce sizes from Sherri, Solo and Imperial Bondware because available polymer inserts would fit and provide enough air space. The top rims can overlap after the poly insert rim is manually de-curled with the application of heat. It is recommended to chill the curl after heat forming. The Polymer inserts used were manufactured by the Letica Maui, Solo Cup and Fabri-Kal in the 12, 14, 16, and 18 ounce sizes. Various combinations were tested with excellent results. To determine sidewall spacing verses outside temperatures the sidewalls of outer paper cup and polymer inner cup circumferences were measured and converted to diameter differences which indicated the insulating air spacing from top to bottom as the sidewall diameters changed. For comparison purposes insulated tumblers were tested and they typically had 1/8 inch separation between sidewalls. Performance data from prior art designs were evaluated where published. For the most part prior art did not publish temperature performance data or sidewall spacings. The insulation results obtained by the designs of this patent have not previously been achieved.

The tables of this patent disclose the performance in tabulated form for typical designs tested.

Definition: A cup or container is comprised of a base with an enclosed bottom disk and a lower rim. Upwardly projecting from the lower rim are vertical sidewalls outwardly diverging at about a 5 to 6 degree angle terminating in an open end which contains a rim that has been outwardly curled in a circular fashion.

FOAM FORMULATIONS

Polymer resins can be formed into foams by the following methods:

1. Gaseous by products from the polymerization reaction.
2. Vaporization of low boiling liquid.
3. Chemical reaction of a secondary heat activated blowing agent.

Generally, flexible foams are open celled. Foams have low thermal conductivity and offer good heat insulation. Low density foams have a thermal conductivity somewhat higher than the gas in itself.

INSERT MATERIALS

Insert material for two wall designs can be any of the following: polystyrene, polyethylene, polypropylene or copolymers. Colors or filler additives as required.

Prior Art

Cups and containers are fabricated from wax coated paper, polyethylene coated paper, polystyrene or styrofoam (expanded polystyrene). Each container is intended for a hot or cold food or beverage application. There were many previous attempts to improve the insulation of paper containers because of the increased use of hotter foods and beverages especially in the area of instant soups and gourmet coffees which require near boiling temperatures to extract the optimum flavors from the product. One prior art container was constructed of corrugated material as described in Patent Number 5,205,473 and Patent Number 5,363,982. There was also another prior art described by Patent Number 5,415,497. One other prior art as described in Patent Number 4,435,344 which entailed applying a layer of polyethylene coating to the container outer sidewall after which the paperboard material was heated to cause blistering. This method was not adequate for insulation purposes for many reasons. It is therefore noted that the blistering polyethylene design and the corrugated or embossed designs have certain disadvantages which this invention addresses.

There are several designs for insulating cups using resin coatings that are applied to paperboard. The cup is formed and heat is applied to cause the resin to expand. In one case data published indicated outer surface temperature of above 145°F with insulating foam thickness of about .090 inches. There are also double wall designs available: some paper, some polymer and paper with intermediate materials used -- usually corrugated. The designs herein depict insulating techniques that contain many improvements heretofore unknown in the art such as optimum dimensional air

spacings without use of added intermediate vertical ribs or other materials between the sidewalls.

In the insulated wrap design of this invention the air space insulation is provided by a polymer extruded foam. There are other foams which can be used at increased cost. Prior art designs that make use of materials that foam after the cup is formed was innovative but the first prior art attempt did not insulate well enough. Improved designs which use this process are quite thick and may not provide enough insulation. In some cases the foam is twice as thick as the foams of this invention yet provide less insulating ability. A commonly used sleeve of corrugated paper is unsightly and bulky, and there is not enough coverage to protect all the fingers. In some car cup holders, the sleeve is at times pulled from the cup or will tilt in the holder. Sometimes they fit loosely on the cup and derive some of their insulating ability by having poor contact. There is much variation in the performance. The corrugated paper end seam sticks out from the side of the cup like a wing, so the cup must be orientated for holding. It does not fit well on all size cups which can be a nuisance. Some corrugated wraps tested were only good for about 2 minutes during test with 190°F coffee in the cup; less than that when a full coverage corrugated sleeve was used. Another type sleeve, which is embossed, performed more poorly than the corrugated when tested. They are also expensive and contain hidden costs since they also are a separately purchased add on. The sleeves' redeeming value is that they are all that is available today and do offer some protection against burns for the first few critical minutes.

Coating a cup with a thermoplastic resin does not as yet yield adequate insulation and the formulation process is extensive. The blistering design as described in Patent Number 4,435,344 requires another process of applying heat after the resin has coated the paperboard to soften the resin and force self-contained gas to escape. The moisture content of the paper must also be controlled. This quasi foam does not provide an adequate thermal gradient from inside to outside surface and that process is not as simple as foam

extrusion which offers superior insulation with less thickness. Although the sheet foam requires laminating, cutting to size and bonding to a cup, its heat performance merits the design. The double wall structure of this invention is the best for cost and performance due to the design implementation used.

Another prior art insulating container is shown by Patent Number 5,752,653. In this prior art disclosure, an insulating container is formed by using two previously formed paper cups joined at the top rim roll. Paper however is not fundamentally as good an insulator when compared to polymers two wall designs. The same is true for embossed paper designs. Therefore to provide the best insulating air barrier a polymer foam or polymer insert is the choice of materials. The obvious disadvantages to an all-paper design in addition to the paper's poor insulating ability is the paper cup fabrication process. Previous designs also employing dual wall structures of same or different materials as described in patents 3,580,468 McDevitt---4,007,670 Albano---3,759,437 Amberg----5,326,019---Wolff--- 4,130,234---Schmidt 5,145,107---Silver and 5,524,817---Meier. The present invention is a new and different design improvement. It was noted that other prior art double wall designs did not suggest outer surface temperature required. Only one suggested minimum air spacing requirements: patent 5,542,599 Sobol, but this is an all paper double wall cup. There was one prior art designs data suggesting low internal temperature use of 170°F to 175° coffee content, patent 4,261,501 Watkins. Therefore this improved design performs at higher temperature and defines spacing dimensions requirements to produce an insulating paper outer and polymer inner cup with the necessary insulation specifically for today's 190°F coffee brewing temperatures.

An insulated foam wrap design or a vacuum formed polymer insert design has many advantages. The wrapped design works well and is simple. The insert design is easy to produce and is not limited in shape since the forming die can be any desired shape. Embossments or enhancements can be added which will become apparent in further descriptions of this invention. Many polymer inserts can be

produced at high speed on roll feed vacuum forming equipment at lower cost than forming of a paper cup. In the design art of insulated containers there are many styrofoam containers. Their disadvantages are that although they can provide adequate insulation, they are very light and subject to tipping or crushing, are environmentally unfriendly and lack good printability. They also impart a styrofoam smell described in prior art which can detract from the flavor of the drink. A thin wall styrofoam container is now available. It is a two piece cup and is fabricated on paper cup making equipment. This design offers reduced insulation compared to normal expanded styrofoam cups because of the thinner styrofoam sidewall. Cup sidewall strength is reduced, it is brittle and can crack. It is not the container of choice in some markets.

Paper cups using polymer coating which are applied to the cup then foamed, as described in patents 5,911,904 Shih is an improved cup but may lack suitable heat insulation. Other similar cups are described in patents 5,725,916 Ishii and 5,766,709 Geddes. Insulating ability based upon patent data and temperature curves do not compare favorably with the containers of this invention. For example, Shih 5,911,904 indicates an outside temperature of about 145°F to 150°F after about one minute's time.

Summary of the Invention

This invention advocates a method of constructing cold or heat resistant containers through the use of commercially available open or closed cell extruded polymer foams. The Foamed polymers are efficient heat insulators since they retard the flow of heat by lengthening or breaking up the heat flow path through interposition of many cellular air spaces. Since these foam products are mass produced in sheet form at low cost they can be laminated to paperboard to produce a thermally insulated container. The second type design of this invention offers an improved double wall structure of paper into which a polymer cup insert is installed. To obtain this improved performance, minimum contact between the two structures is required and the Insulating Air space must be shaped

to reduce heat transfer by conduction and convection. Other spacing arrangements to side and bottoms are disclosed as well a removal of top paper rim or replacement of bottom paper disk with one of polymer which is easier to emboss. A low cost design where the outer wrapper is made of thin wall styrofoam which can be bonded to the cups outer wall, instead of the polyethylene or polypropylene foam, in this case an outer paper wrap again is optional. Another design herein referred to as a flat handle contains insulating material bonded only to opposite faces of the cop in the holding area as described herein.

FOAM MATERIAL PROPERTIES

	POLYPROPYLENE	POLYETHYLENE	BUBBLE	FIBERGLASS
R-VALUE	3.7	3.4	2.4	3.3
MELT POINT	320°F	228°F	200°F	---

TABLE 1

HEAT INSULATION TEST

Test data depicts the performance of a 12-ounce paper cup with .032 inches of polyethylene foam thickness applied to the sidewall. Thickness of .040 to .060 offer lower temperatures. For these foams it was found that for each 10 mills of thickness a comfortable hold time of about 1 minute was derived. Temperature performance can be further improved by adjustments in the foam manufacturing process to reduce density and control air cell shape.

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
Start	185°F	125°F	60°F
1 min.	183°F	130°F	53°F
2 min.	180°F	135°F	45°F
3 min.	175°F	140°F	35°F
4 min.	170°F	141°F	29°F
5 min.	167°F	140°F	27°F
6 min.	165°F	139°F	25°F
7 min.	160°F	136°F	24°F

Subsequent testing using polypropylene of .040 and .050 thickness produced outside sidewall temperature of about 130°F for the wrapped design. Configurations which yield 130°F or less outside sidewall temperature are recommended.

TABLE 2

HEAT INSULATION TEST using .050 polypropylene foam wrap with 14 point SBS outer paper wrap.

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
9:57	182°F	122°F	60°F
9:58	181°F	124°F	57°F
9:59	179°F	128°F	51°F
10:00	178°F	133°F	45°F
10:01	176°F	133°F	43°F
10:02	175°F	130°F	45°F
10:03	174°F	130°F	44°F
10:04	173°F	130°F	43°F
10:06	171°F	128°F	43°F
10:08	169°F	127°F	42°F

NOTE: Pour temperatures were 190°F.

TABLE 3

HEAT INSULATION TEST

1/16 Foam and 22 caliper recycled paper board

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
3:08	187°F	116°F	61°F
3:10	185°F	119°F	66°F
3:11	184°F	122°F	62°F
3:12	182°F	123°F	59°F
3:13	181°F	123°F	59°F
3:14	180°F	122°F	58°F
3:15	179°F	123°F	56°F
3:16	177°F	123°F	54°F
3:18	175°F	121°F	54°F
3:20	173°F	121°F	52°F

In the double wall design of this invention the best thermal results were achieved at the lowest cost. Typical air space tested was in the order of 1/16 (.062), 1/8 (.125), 3/16 (.187) and 1/4 (.250) inches in certain areas for evaluation purposes. The two containers used for testing had sidewall angular differences of about 1/2 degree to 1 degree. A typical all polymer reusable two wall tumbler contained an air space of 1/8 (.125) inches. Another all polymer tumbler with an air space of 1/16 inch in the middle and less at the bottom was hotter on the outer surface. In the designs herein disclosed, optimum delta temperature performance was derived, provided that there was minimum contact between the inner and outer cup. Thicker material will always improve insulating ability. With the double wall design herein disclosed, outside surface temperatures in the 115°F to 135°F range are possible. Test data of this invention included in this application indicates this improvement over prior art designs. It was found during thermal test that when the hand absorbs sufficient calories to raise its temperature to about 115°F to 117°F, the hand will sting (burn). Testing also was performed to ascertain how many calories per unit time was required to produce this effect so that optimum insulation performance could be ascertained. Manual cup holding tests were conducted and thermocouple temperature data was recorded.

It was noted that while the container was being held, the hand contact produced a localized drop in temperature as heat was absorbed through the insulation. The purpose of insulation is to slow down this heat transfer for a long enough period of time. It was calculated that a 16 ounce cup contains 27,000 heat calories. While the disclosed designs exemplify a few of the possibilities, the variations to these designs are many and not limited by the descriptions herein. In addition to specific implementations herein defined there are other techniques known to those practitioners skilled in the art.

TABLE 4

HEAT INSULATION TEST *DOUBLE WALL DESIGN*

*16 oz. paper and a 12 oz. polymer insert was used for test to determine how low the sidewall temperature could be with more air space provided.

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
4:03	184°F	110°F	74°F
4:04	179°F	112°F	67°F
4:05	178°F	112°F	66°F
4:06	177°F	113°F	64°F
4:07	176°F	113°F	63°F
4:08	175°F	113°F	63°F
4:10	172°F	111°F	61°F

TABLE 5

HEAT INSULATION TEST *DOUBLE WALL DESIGN*

CONFIGURATION: 16 oz. Solo Paper Cup with 12 oz. Maui Polymer Cup Insert ("CAFE COOLER") *190°F POUR TEMPERATURE*

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
5:40	186°F	103°F	83°F
5:41	182°F	121°F	61°F
5:42	180°F	122°F	58°F
5:43	179°F	122°F	57°F
5:44	178°F	122°F	56°F
5:45	176°F	122°F	54°F
5:46	173°F	122°F	51°F
5:47	172°F	121°F	51°F
5:48	171°F	121°F	50°F
5:49	169°F	121°F	48°F
5:50	167°F	120°F	47°F

TABLE 6

HEAT INSULATION TEST *DOUBLE WALL DESIGN*

CONFIGURATION: 16 oz. Sherri Paper Cup With A 6.0° Sidewall Angle. Insert Used Was A Fabri-Kal Polymer Cup Model FK12/14S.

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
10:54	183°F	134°F	49°F
10:55	178°F	138°F	40°F
10:56	178°F	139°F	39°F
10:57	175°F	138°F	37°F
10:58	174°F	137°F	37°F
10:59	173°F	135°F	38°F
11:00	171°F	135°F	37°F
11:01	168°F	132°F	36°F
11:02	169°F	133°F	36°F
11:03	168°F	132°F	36°F

TABLE 7

HEAT INSULATION TEST *DOUBLE WALL DESIGN*

CONFIGURATION: 20 oz. Paper Sherri Cup; Insert: 16 oz. Letica Maui cup 16 *190°F water temperature*

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
8:23	185°F	112°F	73°F
8:24	183°F	126°F	57°F
8:25	181°F	130°F	51°F
8:26	180°F	129°F	51°F
8:27	179°F	128°F	51°F
8:28	178°F	128°F	50°F
8:29	176°F	129°F	47°F
8:30	175°F	127°F	48°F
8:31	174°F	128°F	46°F
8:32	173°F	126°F	47°F
8:33	172°F	126°F	46°F
8:35	170°F	125°F	45°F

TABLE 8

HEAT INSULATION TEST *DOUBLE WALL DESIGN*

CONFIGURATION: 16 oz. Sherri Paper Cup With A Sidewall Angle of 4.46° And 14 Oz. Polymer Inner Cup From Fabri-Kal, With A 5.5° Sidewall Angle, White Colored.

Time	Temp. of Contents of Container	Temp. of Outer Surface	Delta Temp. Inside to Outside
10:34	182°F	126°F	56°F
10:35	180°F	131°F	49°F
10:36	179°F	129°F	50°F
10:37	178°F	130°F	48°F
10:38	177°F	130°F	47°F
10:39	176°F	130°F	46°F
10:40	175°F	129°F	46°F
10:41	174°F	128°F	46°F
10:42	173°F	127°F	46°F
10:43	172°F	127°F	45°F
10:44	169°F	126°F	43°F
10:45	169°F	126°F	43°F
10:46	168°F	125°F	43°F

There are improved insulating containers which have foamed surfaces produced by heating a base material such as latex or other carrier containing, in various proportions, additives and agents as thickeners, crosslinking additives, foaming agents, binders, fillers, foam retarders such an Inks or mineral oil to selectively control foam thickness, as well as fine line cutting the unfoamed coating, and various other materials such as described in patents 5,911,904; 5,840,139; 5,725,916 and 5,766,709. The mixtures are applied in unfoamed layers to cup substraits of paperboard after which the formed cup is heated to activate the foaming process. According to data curves published in the aforementioned patents, these designs, however innovative, do not seem to afford the insulating ability of the simpler foams used in the present invention per unit thickness, nor can they match the double wall designs.

NOTE: The amount of heat that flows through any body by conduction depends upon the time of flow, the area through which it flows, the temperature gradient and the kind of material. Stated as an equation:

$$Q = k\,A\,t\,\frac{\text{Delta } T}{\text{Delta } L}$$

Where k is called the thermal conductivity of the material, A is the area measured at right angles in the direction of heat flow, t is the time the flow continues and Delta T divided by Delta L is the average temperature gradient. The symbol Delta T represents the difference in temperature between the two parallel surfaces distant Delta L apart. In the British system, these quantities are usually measured in the following units: Q in Btu., A in square feet, t in hours, Delta T in Fahrenheit degrees and Delta L in inches.

The thermal conductivity k is then expressed in Btu/(ft)(hr)(F/in). The corresponding unit of k in the metric system is cal/(cm)(s)(C/cm).

Brief Description of Drawings

The accompanying drawings illustrate the preferred embodiments of this invention according to the practical applications of the principles thereof, and in which:

FIG. 1 Is a planar view of a preferred embodiment of the beverage container of this invention which depicts insulation in a small area on opposite sides of the container.

FIG. 2 Is a planer view of the preferred container of FIG. 1 showing the laminated layer of foam and paper applied to the beverage container.

FIG. 3 is a planer view of another preferred embodiment of this invention which depicts a polymer cup inserted into a paper cup interlocked at the top rim and providing an air insulation barrier between the two container sidewalls. The inner cup rim totally overlaps and can be adhesively affixed to the outer paper cup rim.

FIG. 3A Is a cross-sectional view of FIG. 3 showing top and bottom embossments of the polymer cup and the lower nesting feature of this design.

FIG. 3B Is a partial cross sectional view of an optional bottom design of FIG. 3 showing a portion of the insert installed through the outer paper bottom.

FIG. 4 is a planar view of another preferred embodiment of this invention which depicts a partial wraparound insulator of foam laminated to a thin paper outer surface. The insulating foam can be polyethylene, polypropylene or thin wall polystyrene.

FIG. 5 is a cross-sectional view of the preferred embodiment of the container depicted in FIG. 4.

FIG. 6 is a planer view of a preferred embodiment of this invention which depicts a 3/4 length insulated wrapper in which the shortened top end is decoratively cut and bonded to a paper cup. The insulating foam can be polyethylene, polypropylene or thin wall polystyrene.

FIG. 6A depicts a cross-sectional view of the cup in FIG. 6 in which the bottom quarter of the insulated wrap is decoratively cut instead of the top edge.

FIG. 7 is a planar view of another preferred embodiment of this invention which depicts the insulating foam material bonded directly to the outer surface of the container sidewall with total coverage. The insulating foam can be polyethylene, polypropylene or thin wall polystyrene.

FIG. 8 is a cross-sectional view of the preferred container of FIG. 7 depicting the insulating foam adhered to the surface of the container.

FIG. 9 is a planar view of a preferred embodiment of the container in this invention which depicts a full coverage wrapper of paperboard and foam insulation bonded to the outer sidewall surface of the container.

FIG. 10 is a cross-sectional view of the preferred container depicted in FIG. 9 in which the underlying insulating foam is shown.

FIG. 11 is a planer view of FIG. 9 in which an outer band is shown which allows cup nesting.

FIG. 12 is a planer view of the cup in FIG. 9 which depicts a sidewall projection which is another method to allow cup nesting.

FIG. 13 is a planer view of FIG. 9 which depicts a butt joint connection of the insulated wrap.

FIG. 14 is a planer view of FIG. 9 which depicts an overlapping insulating wrap. FIG. 14 also depicts at the bottom of the cup a raised false bottom to allow cup nesting.

FIG. 15 is a partial view of the bottom of the outer cup in FIG. 3A in which the paper cup bottom contains air vents.

FIG. 16 is a planer view of the cup in FIG. 3, a double wall structure, in which the outer paper sidewall contains air vents.

FIG. 16A is a cross-sectional view of an optional bottom of the outer paper cup of FIG. 3A wherein a polymer bottom replaces the paper bottom and has an optional vertically rising embossed shape at its center which fit into a like shaped embossment of the inner polymer cup to securely align the two cups.

FIG. 17 is a planar view which depicts a double wall cup in which the inner cup rim partially overlaps and is adhesively joined to

the outer cup rim.

FIG. 18 is a cross-sectional view of the double wall cup embodiment of FIG. 17 with embossments at the top of the inner cup for spacing and the two cup rims in partial overlap configuration.

FIG. 18A depicts a partial planar view of the inner cup of FIG. 18.

FIG. 19 depicts a double wall structure in sectional view with the outer cup's paper bottom removed. The insert now extends lower into the outer cup into the bottom incurl area.

FIG. 19A depicts a partial view of another insert optional bottom of FIG. 18, which is recessed and shown with a defined rim to provide minimum contact between the inner and outer cup bottoms.

FIG. 19B is a partial sectional view of FIG. 18's polymer insert's bottom, with another optional center embossment used for spacing or mating with like embossments in the outer paper cup's bottom.

FIG. 20 depicts a cross-sectional view of a double wall cup in which the insert cup's rim is formed to rest on the outer paper cup's inside rim area before the sidewall becomes straight in a flush meeting of this area of curvature to allow standard cup lids to fit on the outer paper rim without interference from the polymer insert rim.

FiG. 20A is a partial detailed view of a section of the top of the structure shown in FIG. 20 in which the inner polymer rim is recessed and adhesively affixed and can be seen in close contact with the inside curve of the outer paper cup rim.

FIG. 21 depicts a sectional view of a double wall cup where the insert is suspended from the top with the only top contact area being the overlapping rims and the inner cup's top embossment.

FIG. 22 depicts a detail view of the polymer cup being inserted into a rimless paper cup. The bottom of the paper cup and the bottom of the polymer cup contain an embossed alignment feature which interlocks.

FIG. 22a is a sectional view depicting the outer paper cup top edge in relationship to the inner polymer cup's top rim. The top of the paper cup is in contact with the circular embossment at the top of the polymer cup.

Detailed Description of the Invention

The invention herein describes an insulating food or beverage container which consists of a thin cellular foam material with low thermal transfer characteristics. The foam which is commercially available in sheet form at low cost can be bonded to the container surface in its normal form, laminated to paperboard stock before being applied to the container sidewall, or laminated to the paper board stock directly as it is being extruded. The preferred embodiment of this invention is polyethylene or polypropylene foam with a thickness on the order of .030 to .050 inches. Thin wall polystyrene foam can also be used as an insulating wrap. The foam can be selectively applied or completely cover the outer container surface.

FIG. 1 and FIG. 2, shows two views of a preferred embodiment of the finished beverage container 200 of this invention. The insulation material 13 has been previously bonded to a thin paperboard covering 12 and has been selectively applied on opposite sides of the paper container 15 in a "flat handle" design. 14 is the top rim.

FIG. 3 is another preferred embodiment of this invention. A standard paper cup 15 is the outer surface of this design into which a polymer cup 16 has been inserted to provide a surrounding air barrier between the two container sidewalls to produce finished container 300. The spacing between sidewalls should be about 1/16 to 1/8 of an inch with 3/16 to 1/4 inch in selected areas providing more insulating air and lower outside surface temperatures. The inner cup's top lip roll covers and locks around the outer paper cup lip roll in close contact and can be adhesively bonded to provide a rigid structure. The outer paper rim 301 is covered by the inner polymer cup rim 302. The inner cup top outward facing spacing and strengthening embossment contacts outer paper cup 15 at the top.

FIG. 3A is a cross-sectional view of the cup in FIG. 3 showing the top outer facing spacing and strengthening embossment 303. 17 is the reduced lower diameter of the inner container whose top rim is

used for nesting another cup. Inward facing embossment 19 increases the nesting surface of stackable cups. 39 is the air space between sidewalls, 21 is the paper cup's recessed bottom, 35 is the paper cup's bottom rim, 16 is the inner polymer cup, 301 is the outer paper rim, 302 is the inner polymer cup's rim and 15 is the outer paper cup.

FIG. 3B is a partial cutaway view of the bottom of FIG. 3A. 21A is a detail view of an optional inner cup projection which goes through a receiving hole in the paper cup's bottom commonly known as a false bottom. 21C is the hole in the paper cup's bottom, 21B is the remaining bottom and 16A is an optional polymer cup configuration. 39 is the air space between sidewalls. 15 is the outer paper cup.

FIG. 4 and FIG. 5 is another preferred embodiment of this invention which depicts completed container 400 consisting of paper cup 15 which has insulating foam material 20 which can be polyethylene, polypropylene or thin wall polystyrene foam which has been bonded to a thin paperboard wrapper of kraft, clay, SBS or other suitable material 18, applied to its outside surface. The insulation assembly is bonded to and covers a partial area of the container's outer surface. 14 is the top rim. 35 is the paper cup's bottom rim.

FIG. 6 and FIG. 6A is another preferred embodiment of the invention wherein the insulated wrap consisting of foam and paper laminate 25 has been bonded to the cups. In FIG 6, the upper part of the wrap has been decoratively cut 31 to reduce material usage. In FIG. 6A the bottom of the wrap has been cut in decorative fashion 20 to reduce material usage. 30 is the foam material which can be polyethylene, polypropylene or thin wall polystyrene. 15 is the underlying cup, 500 is the finished container, 14 is the top rim. 15 is the outer paper cup and 35 is the paper cup's bottom rim.

FIG. 7 and FIG. 8 depicts another preferred embodiment of this invention in which the insulation foam 30 which can be polyethylene, polypropylene or thin wall polystyrene, is bonded directly to the cup 15 to produce a finished container 500. 14 is the top rim.

FIG. 9 is a planar view of the completed cup 600 and FIG. 10 is a sectional view showing foam insulation 20 sandwiched between the container and an outer wrapper 25 of suitable material such as paperboard. Wrapper 25 covers the full cup outer surfaces. 14 is the top rim and 15 is the outer paper cup.

FIG. 11 shows an insulated wrapped cup 700 in which a band of material 25-3 is bonded to the top area and sits on the rim of the next stacking cup so that nested cups can be de-nested easily. This feature is in lieu of a raised false bottom commonly used to facilitate nesting. 14 is the top rim, 15 is the outer paper cup and 25 is the outer paper wrap.

FIG. 12 is an alternative method of allowing cups to be stacked by employing a projecting material 25-2 which has been applied to the insulating wrap 25 of finished cup 800. 14 is the top rim. 15 is the outer paper cup.

FIG. 13 depicts a planer view of an insulating wrapper on a cup 15 in which the foam and paper wrapper 25 is applied and its ends form a butt joint 22 to produce a finished cup 900. 14 is the top rim, 15 is the outer paper cup and 35 is the paper cup's bottom rim.

FIG. 14 is another preferred embodiment of a foam and paper wrap bonded to the cup 15 in such a way as to have the insulating wrap ends form an overlapping joint 30 which is adhesively bonded. The finished cup is 901, 14 is the top rim, 15 is the outer paper cup, 25 is the outer paper wrap, and 35 is the paper cup's bottom rim.

FIG. 15 depicts another optional paper bottom from the double wall structure of FIG. 3 in which the paper bottom sectional view 31a has vents 31 cut into it to allow heat and moisture to escape from the insulating air space between the adjacent sidewalls. This embodiment is referred to as 1000, 16 is the inner cup, 17 is the bottom reduced diameter of the inner cup, 15 is the outer paper cup, 35 is the paper cup's bottom rim.

FIG. 16 is a planar view of a double wall cup 1100 which has vent slots 32 in its outer paper sidewall 15 to allow heat and moisture to escape.

FIG. 16a depicts an optional polymer bottom 34 which replaces a

paper bottom on an outer paper cup. An internally rising center embossment 33 fits into a similar inverted shape on an optional inner polymer cup's bottom. This provides alignment of the adjacent sidewalls of the insert and the outer paper cup. 35 is the ridge formed by the paper outer cup's sidewalls as it extends below the raised bottom, 15 is the outer paper cup, 34a is the paper cup's plastic bottom which has a downwardly facing sidewall which becomes bonded to the outer paper cup's incurled sidewall.

FIG. 17 depicts in planer view a double wall cup in which the inner cup's rim 37 is in partial overlap cover of the paper outer cup's rim 36 to produce finished cup 1300. 37A is the modified inner polymer cup with a reduced rim curl and 15 is the outer paper cup. FIG. 18 is a cross-sectional view of the double cup in FIG. 17 in which 39 is the interwall air space which must be equal on both sides. The topmost outward facing embossment spacer 303 can be solid or segmented as it circulates around the top of the polymer inner cup 16 and is formed by a diameter reduction. Embossment 304 is formed by a second diameter reduction at the top of the cup whose purpose is to strengthen the sidewall of the insert 37A. 36 is the outer paper cup's rim, 37 is the inner cup's rim, 305 is the lower embossment of the inner cup, 306 is the bottom diameter change which provides cup nesting.

FIG. 18A depicts a cutaway view of the inner cup of FIG. 18. The inner cup's rim 37 has been shortened to contact the outer rim 36 of FIG. 18. The first diameter reduction 303 at the top of the inner cup, provides the initial spacing and alignment of the inner and outer sidewalls of FIG. 18. The next diameter reduction 304 of the inner cup provides strength to the sidewall. The first lower diameter reduction 305 of the inner cup strengthens its sidewall. 306 which is the lower diameter reduction provides an inner edge for cup nesting. 37A is the polymer inner cup.

FIG. 19 shows the double wall structure 1400 in a cross-sectional view wherein the bottom of the paper cup has been removed. The inner cup extends into the area where the outer cup's bottom has been removed and contacts the bottom incurl which normally secures

the paper cup's bottom. The poly coating on the inside of the paper cup to moisture proof is removed since the hot liquid is contained by the insert. 40 is the inside of the outer paper cup which has had its poly moisture coating removed. 41 is the outer paper cup's sidewall, 42 is the inner polymer cup, 43 is the paper cup's bottom incurl which is an overlapped fold of the paper cup's sidewall. Removing the paper cup bottom reduces the cost its fabrication.

FIG. 19a shows a polymer insert bottom area with an optional recess 77 which can be employed in the various double wall designs. With this recessed bottom structure the raised edge forms a rim 76 and this polymer insert's rim can rest on the outer cup's paper bottom in a minimum contact configuration to reduce heat transfer to the outer paper cup. 70 is the polymer insert's reduced bottom diameter for nesting cups, 75 is a bottom embossment to increase ridge area and 79 is the polymer cup.

FIG. 19b is another manifestation of FIG. 19a which depicts an embodiment in which the bottom contains a shaped projection 80 which can be used as a spacer or alternatively fit into like receptive areas of the paper cup bottom which can be either paper or a polymer, instead of a recessed area. 81 is the insert cup's bottom, 82 is the reduced diameter sidewall, 83 is the nesting ridge and 84 is the polymer cup.

FIG. 20 is a cross-sectional view of another variation in the double walled cup preferred embodiment in which the polymer insert top edge 20C has an abbreviated rim when inserted into the paper outer cup and comes to rest and is flush with the inner portion of the paper cup's rim 20B just at the end of the inside curved area, where it is bonded. Because the insert's rim does not add thickness, this design permits the cup lid to fit over the outer paper cup's rim in locking fashion. In this case the paper cup's upper inner surface and rim are coated with a moisture resistant coating to prevent liquid from being absorbed by the paper outer cup. The completed structure is 1500, 51 is the polymer inner cup with the shortened rim, 15 is the outer paper cup of this assembly, 35 is the paper cup's lower rim, 52 is the paper cup's bottom, 50

denotes the surface area not required to be moisture coated on the paper cup, 53 is the upper polymer cup's alignment means, 54 is a reduced diameter sidewall section of the polymer cup, 56 is the lower reduced diameter of the polymer cup provided for nesting purposes and 39 is the inter sidewall insulating air space.

FIG. 20A is a sectional view 1501 of a portion of the rim area depicted in FIG. 20 with the polymer inner rim 20C and the paper outer cup's rim 20B in close bonded contact.

FIG. 21 is a cross-sectional view of a double wall container in which the polymer insert is floating inside the paper outer cup with minimum contact between the inner polymer cup and the outer paper cup sidewalls. The only contact is at the top 58 to define the air space 39 between the sidewalls and provide stability. The polymer cup rim 57 totally overlaps the outer paper cup's rim and is adhesively bonded or heat formed to be in close contact and surround the paper rim in an outwardly curled fashion. The polymer insert's bottom contains a reduced diameter nesting ridge 59 and has an inwardly embossed section 61 to increase this nesting area so that the next stackable cup does not bind as their lower diameters merge during insertion. 52 is the paper cup's bottom, 35 is the paper cup's lower rim, 43 is the paper cup's bottom incurl which bonds the bottom to the sidewall, 15 is the paper cup, 60 is the polymer insert, and the completed cup structure is 1600.

FIG. 22 depicts another double wall structure in telescopic view in which the polymer cup 63 is shown as it is inserted into a paper cup 64 which has no top outwardly facing curled rim 62. The top edge of the paper cup now inserts under the polymer inner cup's rim and rests upon and is adhesively bonded to the outward facing continuous or segmented embossment 66 at the top of the polymer cup. The paper cup's bottom 70 in this case is comprised of a polymer material, and contains a vertically rising embossment at its center to mate with the polymer cup. The polymer cup's bottom is recessed in its center area 69 to form a circular depression. These two mating features 69 and 71 cooperate in the alignment of the polymer insert to provide symmetrical air space between the

sidewalls. The mating feature may be adhesively bonded to eliminate bonding at the top rims. 67 is the lower embossment on the polymer cup, 68 is the polymer cup's lower diameter reduction which provides a ridge for cup nesting, 72 is the embossment at the bottom of the polymer cup's smaller diameter to provide more nesting surface on the inside edge and 71 is an embossment formed in the paper cup's polymer bottom at the center.

43 is the paper cup's bottom incurl used for locking the paper cup's bottom in place. 35 is the paper cup's bottom rim.

FIG. 22A shows a partial cross-sectional view of the top of the polymer cup of FIG. 22 in which 65 is the overlapped polymer rim which covers the paper top rim, 66 is the top outward facing embossment produced by a diameter change at the top of the polymer cup, 63 is the polymer cup sidewall, 64 is the outer paper cup and 39 is the insulating air space.

Claims

What is claimed is:

1. A method for producing an insulated cup or container by bonding extruded polymer foam which is closed cell in nature, in the polyolefin family, preferably polyethylene or polypropylene in a thickness range of .020 to .060 inches or more, or a thin wall polystyrene, to a container outer sidewall.

2. A method according to claim 1, wherein the foamed insulation material has been laminated to a paperboard or other material; the composite wrap then being bonded to the container outer sidewall wherein its horizontal edges are cut in a straight or decorative fashion, in partial or total coverage, the vertical edges of which are joined to form a seam which is abutted or overlapped; and cup nesting means is provided either near the top rim in the form of a circular band or a protruding element extending horizontally from the sidewall, or by the cup's bottom being raised toward the top rim for nesting.

3. A method of producing an insulating container wherein a closed bottom polymer insert has been co-axially installed into an outer paper cup; the two containers' top rims overlapping in a bonded fashion and said insert's sidewall is spaced apart from the adjacent paper sidewall due to the angularity difference of the cups' vertical sidewalls which allows a chamber of insulating air to be contained; while a reduced inner cup diameter provides initial sidewall contact and spacing to the upper adjacent sidewalls in a minimal contact fashion to define said spacing, and the bottom of said insert is spaced apart from the outer cup's bottom, or bonded or in partial or interlocked contact.

4. A method according to claim 3 wherein the inner polymer rim, basically horizontal, contacts and is adhesively bonded to the outer paper cup rim in slightly recessed fashion to tapered contact below the crest of the curved outer paper cup rim to fit standard cup lids.

5. A method according to claim 3 wherein the polymer rim curl is abbreviated and in flush contact adhered to the top of the paper

rim so as not to interfere with the paper cup lid locking feature.

6. A method according to claim 3 wherein the inserted polymer cup contains a more flattened rim curl which when coaxially installed into the outer paper cup, rests in flush, tapered and bonded arrangement with the inside of the paper cup's rim in the area where its curvature begins, to allow a standard cup lid to fit.

7. A method according to claim 3 wherein single or multiple diameter changes exist in the polymer insert's sidewall providing strength, and said sidewall containing a diameter reduction near its bottom to form an inwardly facing ridge for nesting cups.

8. A method according to claim 3 in which the polymer inner cup top rim contains a non-overlapping slightly curled horizontal lip bonded to the paper cup's top rim, and with moisture resistant poly coating being applied to the uncovered paper top rim area.

9. A method according to claim 3 wherein the paper outer cup lacks a top rim and contains a generally straight top edge which contacts is spaced by and bonded to a segmented or circular outward facing embossment of the inner polymer container; said embossment being a smaller diameter change occurring below the top rim curl of the polymer inner cup wherein the outer paper cup top edge is in close contact and nestled beneath said polymer insert cup's curled rim, and minimum or no moisture coating is required on the inside sidewall of the outer paper cup.

10. A method according to claim 3 in which the outer paper cup contains no bottom disk but retains the bottom fastening incurl produced by the sidewalls' inward facing overlapped surfaces.

11. A method according to claim 10 wherein the inner polymer cup bottom extends down into the vacated area left by removal of the paper cup's bottom, and the bottom side portion of said inner cup is bonded to and supports the paper cup's bottom incurl.

12. A method according to claim 3 in which the inner cup's bottom center has a means to interlock at the center of the outer paper cup's bottom disk wherein the insert's bottom can be concave and have edges formed into a raised rim, or the insert's bottom may contain a dimple to space the bottoms, or it can mate with a like

depression in the center of the outer container to maintain symmetrical sidewall alignment.

13. A method according to claim 3 in which the inner polymer cup contains outward facing embossments which space the paper outer cup's sidewalls to maintain symmetrical alignment between the inner and outer cup's sidewalls.

14. A method according to claim 3 wherein the paper bottom or sidewall can contain vent openings to remove moisture or heat.

15. A method according to claim 3 in which there is a primary outward facing embossment or diameter reduction at the top of the polymer insert which provides contact with the outer paper cup in that area in such a way as to help define the shape of the inter sidewall air space and provide insertion alignment between the two cup sidewalls, or there may be other embossments or diameter changes formed in the inner polymer cup's sidewall with said air space graduated along the adjacent sidewalls from top rim to bottom after some initial sidewall contact to spacings starting at about 0.062 inches or less, then increasing to a predominate spacing of about 0.125 to 0.187 inches with lower sections spaced by as much as 0.20" to 0.30 inches; the bottoms being in contact or spaced apart typically from 0.062 to as much as 0.50 inches.

16. A method according to claim 3 in which the shaped inter wall insulating air space cooperates to provide an outside paper wall surface temperature which is in the range of about 110°F to 140°F.

17. A method according to claim 3 wherein the inner polymer insert is suspended by the outer paper cup's top rim configuration; said insert's rim curl being in overlapping contact with the paper outer cup's rim after which the polymer insert contains an upper decrease in diameter which dictates generally the air spacing between the remaining sidewalls and subsequent air space determined by the differences in sidewall angles, resulting in the insulating air space between said sidewalls being related to cup size, volume, angularity, and nesting.

18. A method according to claim 3 wherein the polymer insert can withstand at least 190°F temperatures without change of shape.

19. A method according to claim 3 wherein said outer paper cup contains a polymer bottom to facilitate forming of bottom shape embossments for interlocking inner and outer container bottoms or provide bottom spacing means.

20. A method according to claim 3 wherein the outer paper cup's paper bottom has been replaced by a polymer material which has its center area formed into a vertically rising shape or dimple which engages a like formed recessed area of the inner polymer insert's bottom disk at its center wherein these shapes cooperate to bond the two containers together or engage to align the two cups and provide symmetrical air spacing between and along the adjacent sidewalls.

FIG. 1

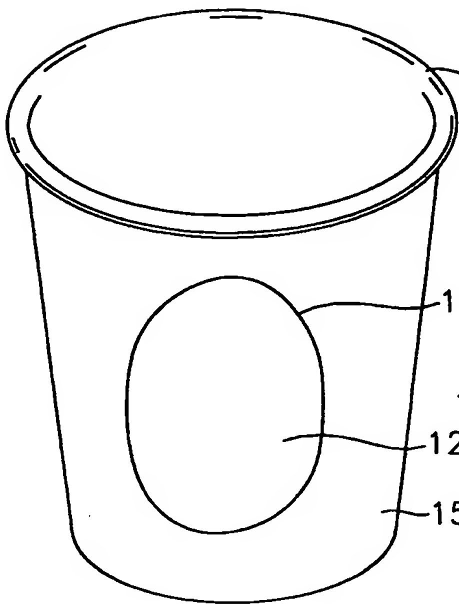


FIG. 2

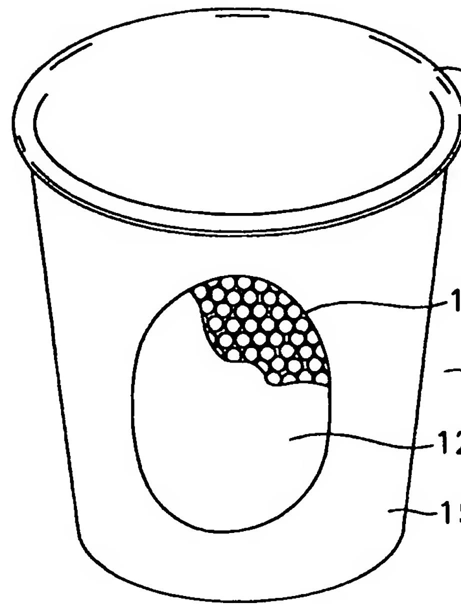


FIG. 3

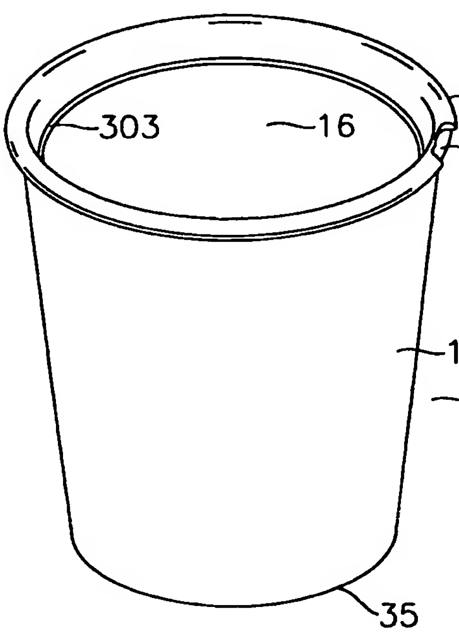


FIG. 3A

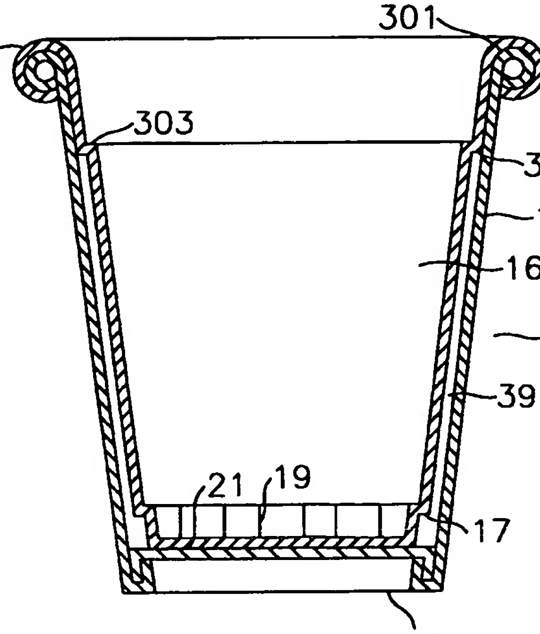


FIG. 3B

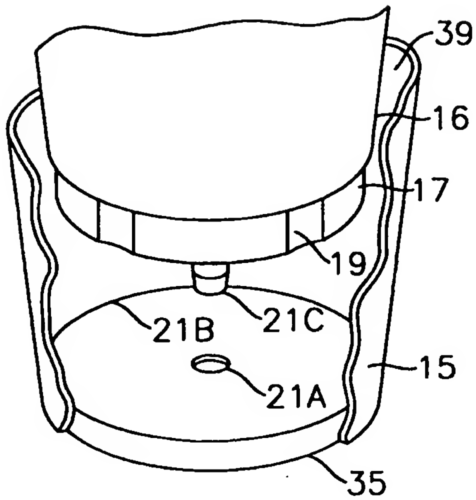


FIG. 4

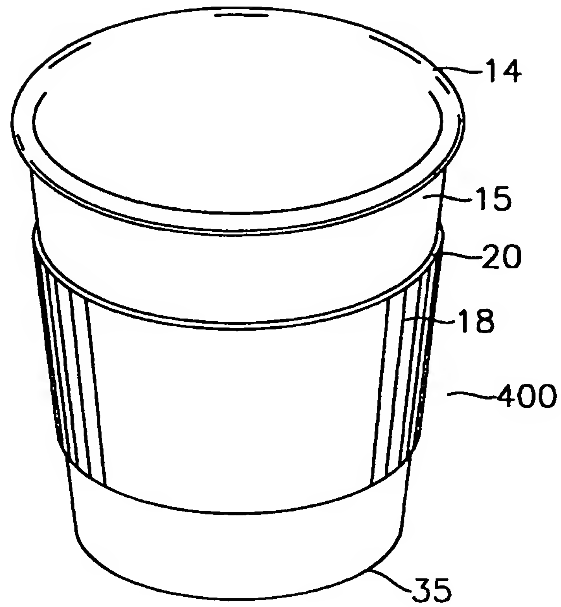


FIG. 5

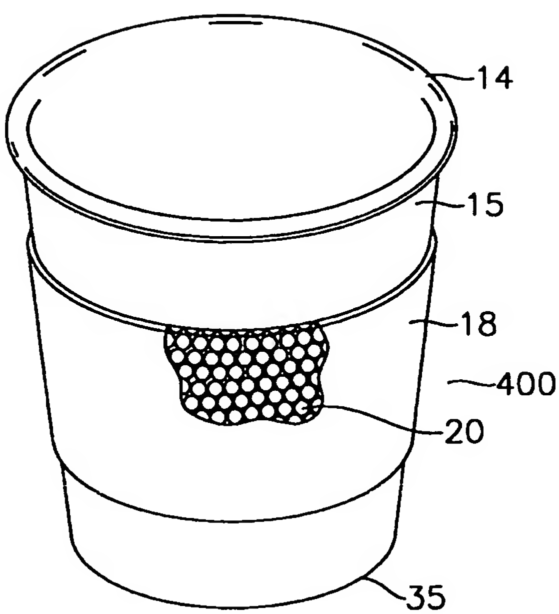


FIG. 6

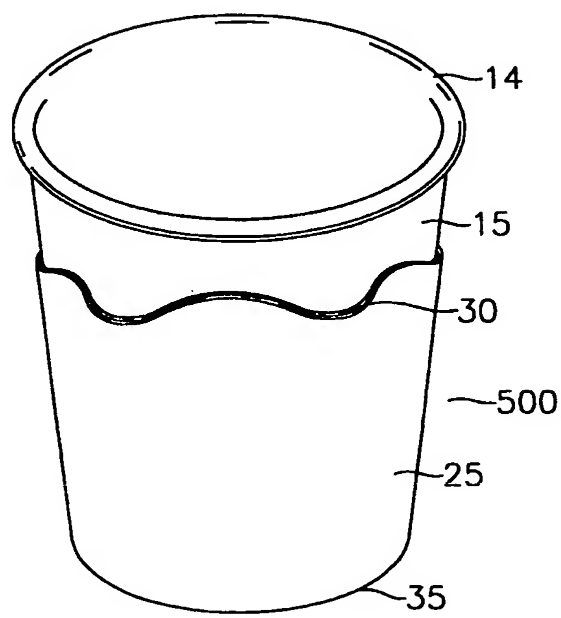


FIG. 6A

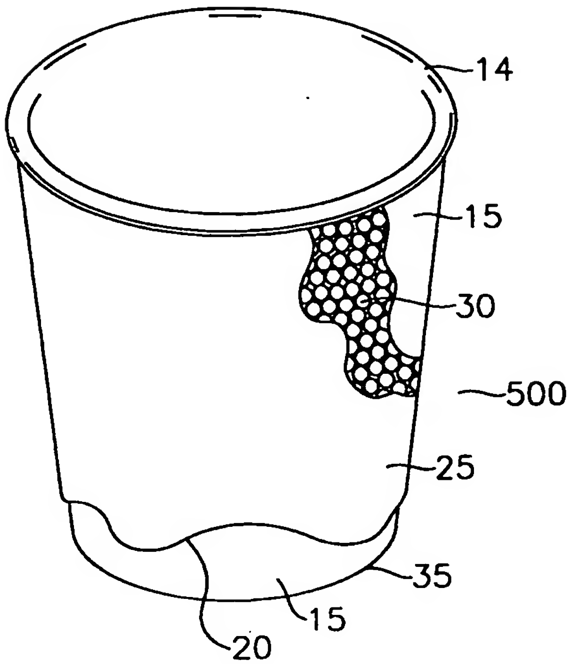


FIG. 7

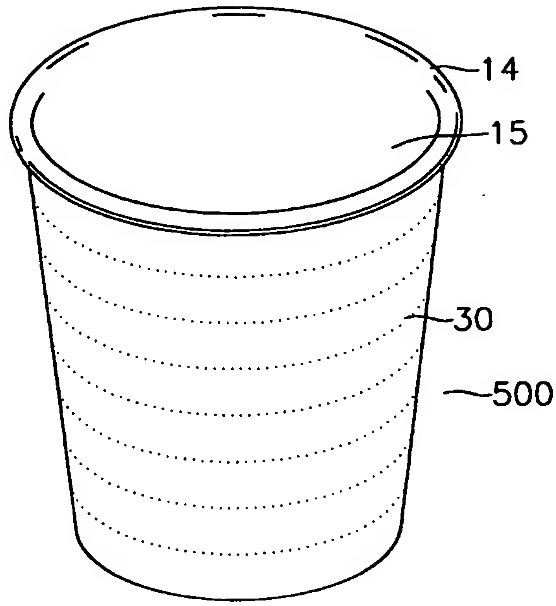


FIG. 8

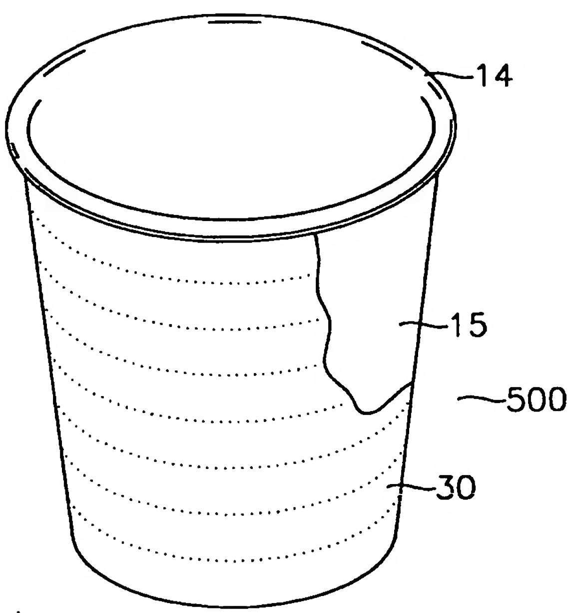


FIG. 9

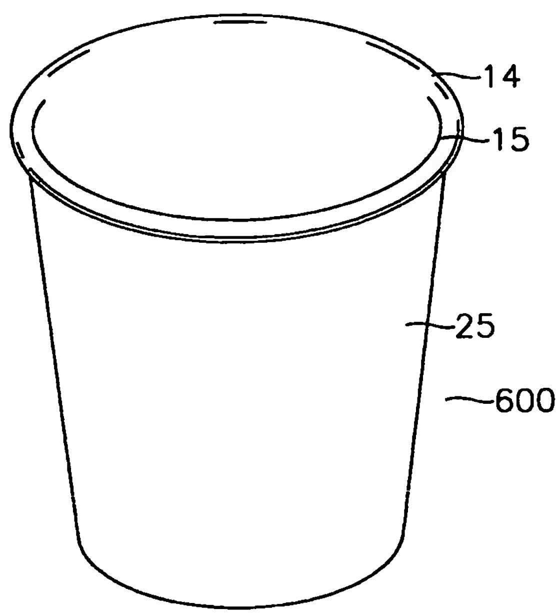


FIG. 10

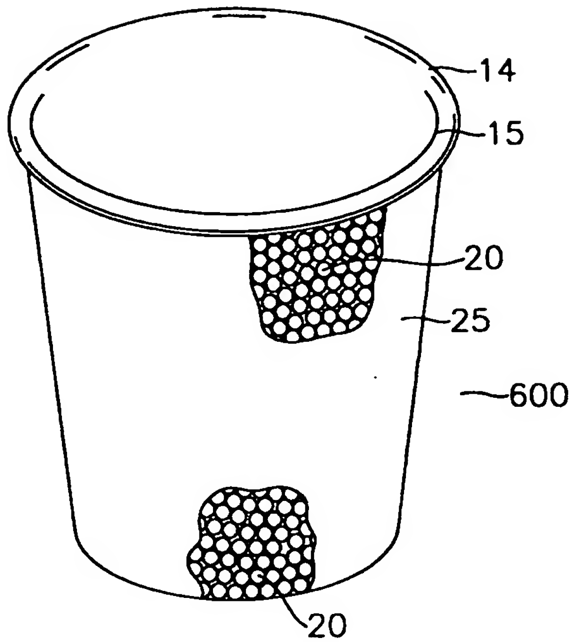


FIG. 11

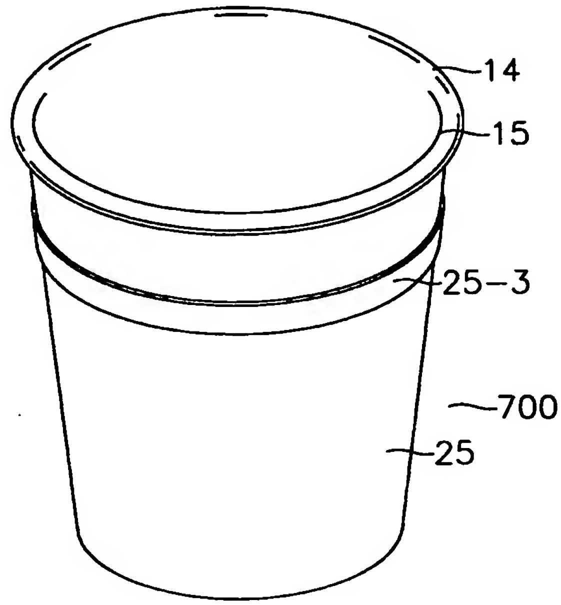


FIG. 12

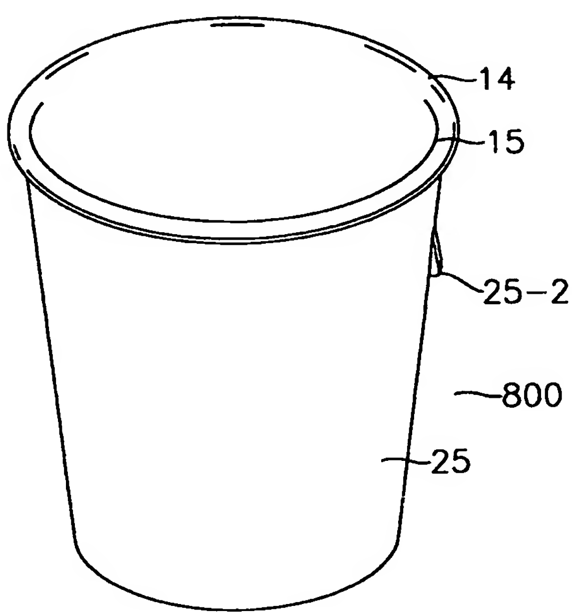


FIG. 13

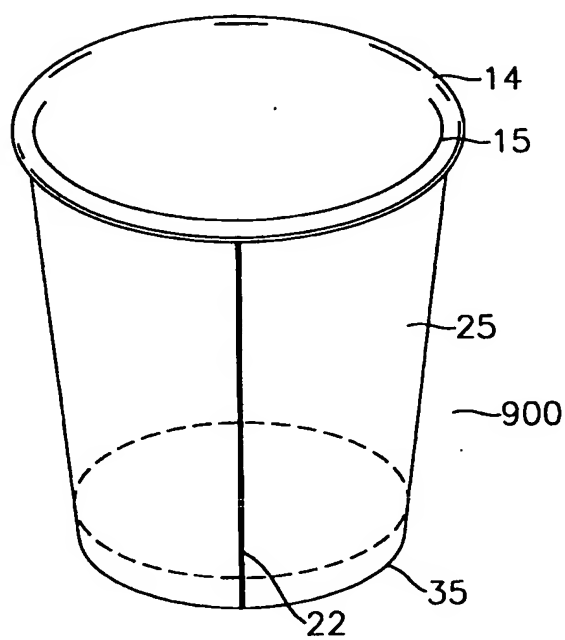


FIG. 14

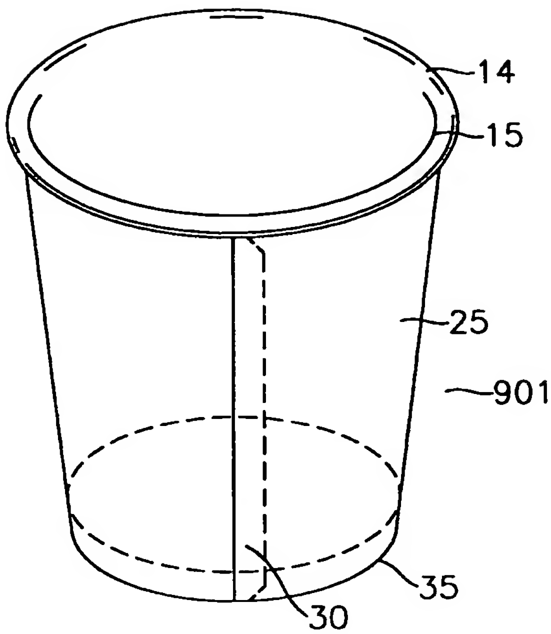


FIG. 15

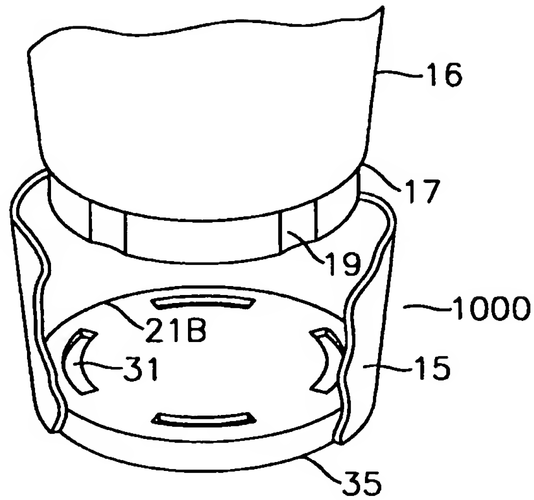


FIG. 16

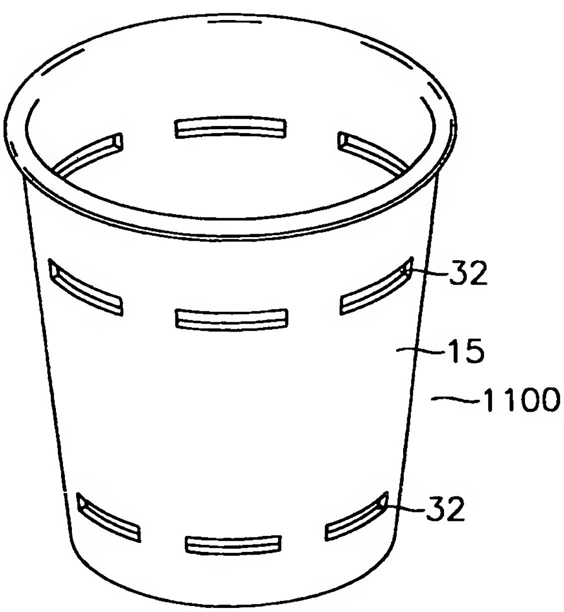


FIG. 16A

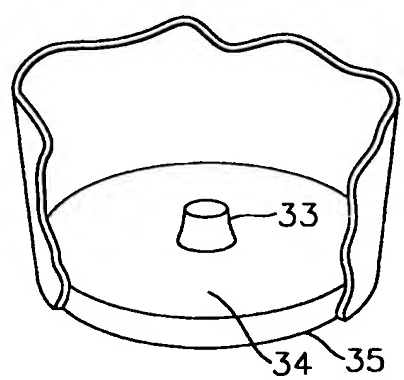


FIG. 17

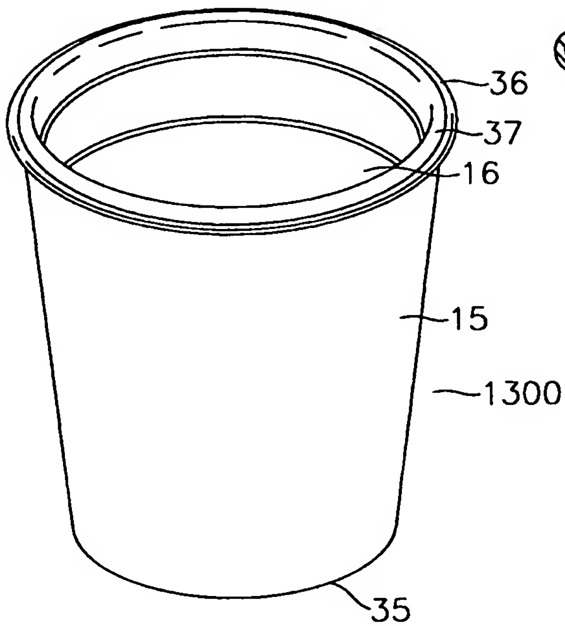


FIG. 18

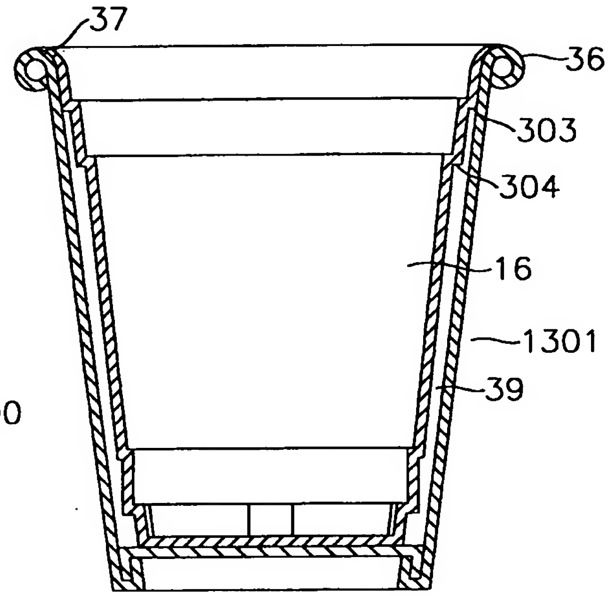


FIG. 18A

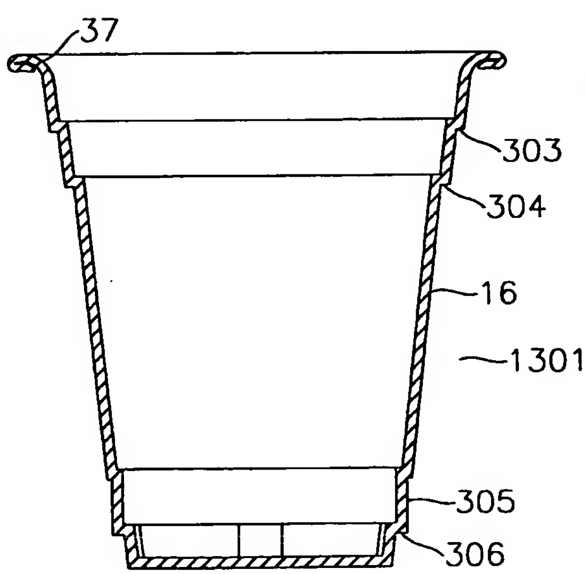


FIG. 19

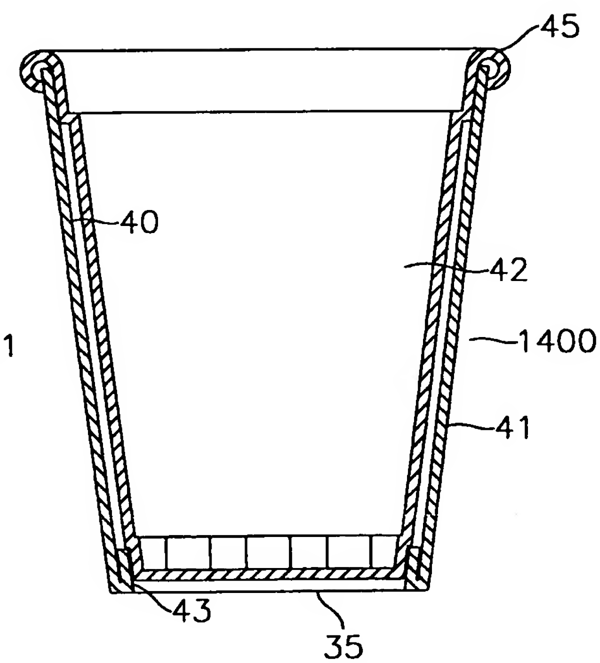


FIG. 19A

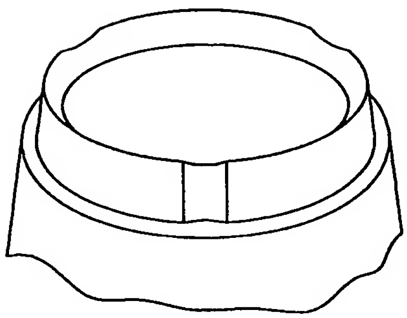


FIG. 19B

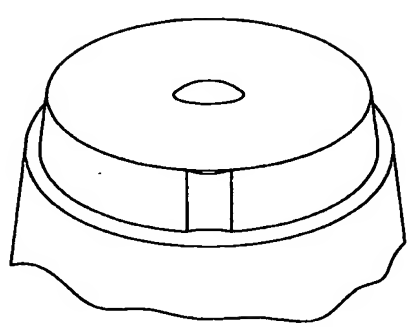


FIG. 20

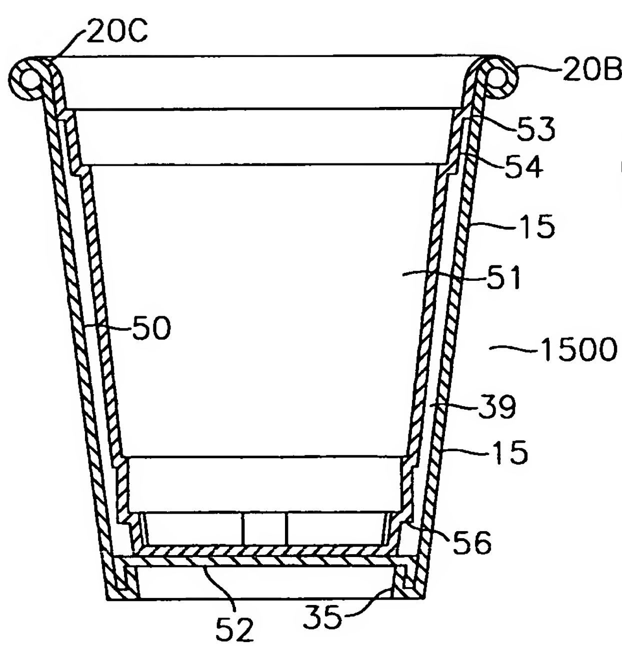


FIG. 20A

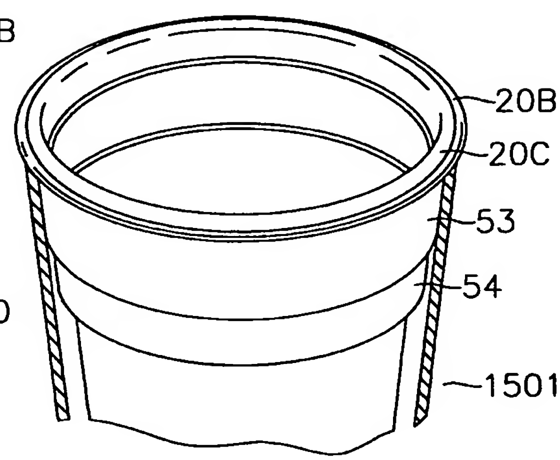


FIG. 21

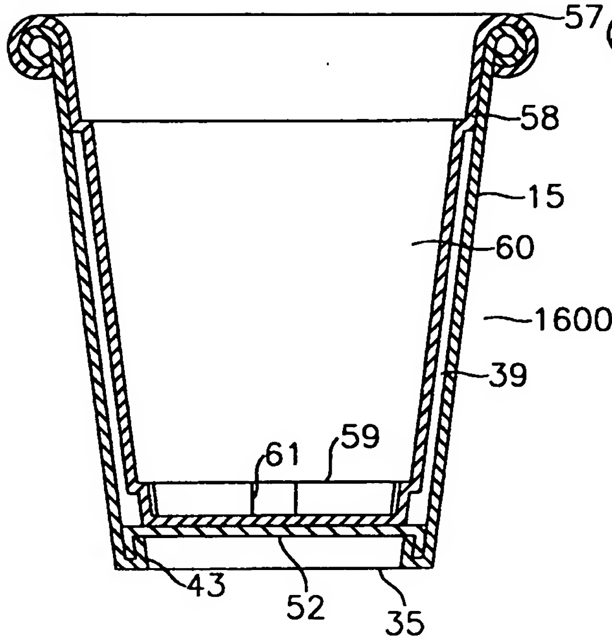


FIG. 22

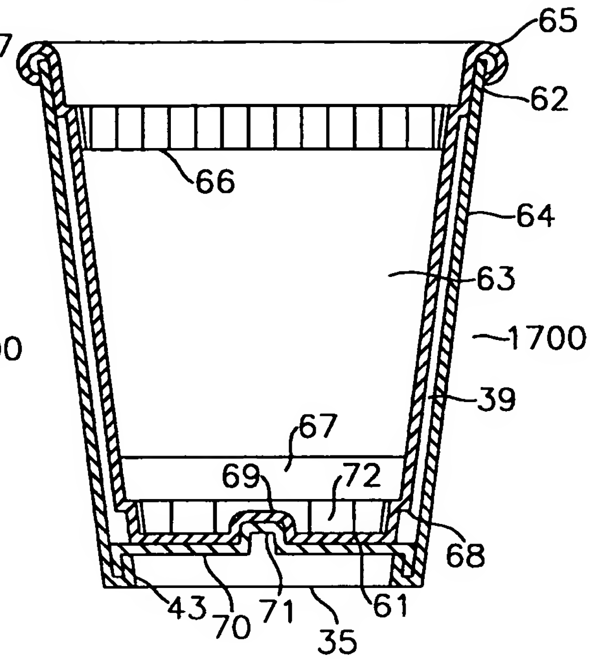


FIG. 22A